

Lecture Notes in Networks and Systems 1752

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Editors

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Innovating and Modernizing Teacher Training to Prepare it for Future Challenges

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Abstract. We live in a time when digital technologies play an absolutely central role in all economic sectors, including education. As education is one of the main pillars of a country's development, there is a constant need to adapt schools to the new times. To this end, it is essential to innovate and modernize teacher training to prepare teachers for the future challenges that all this technological growth will bring us. This article aims to identify, in general, a set of innovations that can be integrated into teacher training. A bibliographic survey was carried out according to a predefined set of criteria. Once the documents had been collected, a content analysis was carried out to identify current innovative trends in teacher training. Several innovations can be organized into two broad categories: technology and pedagogy. The results highlight the importance of innovation in teacher training to make a more significant contribution to the quality of the teaching-learning process and, consequently, to student education.

Keywords: Digital technologies · Innovation · Modernization · Teacher training

1 Introduction

Teacher training contributes to helping teachers improve their practices, equipping them with useful skills [1–4] and knowledge to face the challenges in various learning contexts [5, 6], for example, artificial intelligence, among many others. If education, namely its infrastructures, processes and students are increasingly digital, then teachers must align themselves with the school and acquire the skills that will enable them to carry out their work effectively and efficiently today, as professionals whose job it is to educate citizens of the 21st century. It's not just that digital is important in teaching and learning processes, it's also because new and emerging technologies, communities and platforms provide teachers with greater access to training [7, 8]. In this sense, continuous training geared towards innovation can help prepare teachers to keep up with the dynamic changes in society and students for an increasingly digitized future. Thus, investing in digital innovation in teacher training not only raises the quality of teaching but also empowers the next generation to face the challenges and transformations of the 21st century.

This research aims to identify the main innovative trends in teacher training. In this way, these professionals have the opportunity to take part in innovative training

activities and, through them, acquire modern, up-to-date, and useful skills for carrying out teaching-learning processes that are more appropriate to reality.

This article consists of five sections: Introduction (contextualizing the topic under investigation); innovating in teacher training (pointing out some of how innovation can contribute); methodology (identifying and explaining all the methodological options); results (identifying the main results - innovations for teacher training); conclusions (presenting the main conclusions drawn from the study).

2 Innovating in Teacher Training

Innovating teacher training to make it up-to-date and useful to truly respond to the needs of the school and society in which we live must be a priority [9–11], not only because of the growth of the technology market and, consequently, the wide range of cutting-edge digital technologies on offer, but also because of the cultural and social transformations that schools have undergone in recent years and which teachers really must keep up with, otherwise they will be outdated.

The fact that the growth of information and its accessibility through networks is increasingly evident [12–14], that teacher training will also be increasingly linked to learning networks, which means that its implementation will increasingly depend on digital technologies. It is important to note that since 2020, digitally supported remote learning or online learning has increased exponentially for people with access to digital devices connected to the internet [15]. Online learning is the fastest-growing [16], also referred to as virtual learning, e-learning, or web-based learning [17]. This expansion is driven by the accelerating rate of global internet access. In January 2023, 64.5% of the world's population - more than 5 billion people - had access to the internet, and 95% had coverage, i.e. lived within range of a broadband signal [18–20].

Teacher training can also take place online, as this format is one of the best known and most relevant ways for teachers to keep up with changes in education, not least because new and emerging technologies, communities, and platforms provide teachers with greater access to teacher training [7, 8]. In contexts as diverse as Estonia, Uruguay, and Egypt, teacher training is offered online [21]. In Europe, the European Council, namely the Department for Education, has been developing online courses since 2017 that offer practical teaching and training resources to education professionals across Europe, with emerging themes such as digital citizenship, literacy, and learning [21].

In the Caribbean, teachers can participate in courses through Zoom and Moodle or at one of the 44 Open Campus distance education centers [16]. In Asia, Open Universities, such as those in India and Nepal, also offer online programs aimed at continuing teacher training [16]. Also in Qatar, the online portal e-Taleem has a catalog of 55,000 online courses in dozens of degree programs. An Irish online learning platform, it has become a popular site for workplace-based continuous learning, including courses related to teachers and teaching [22, 23]. In sub-Saharan Africa, the Initiative Francophone Pour la Formation à Distance des Maîtres (IFADEM) has promoted online training to support teachers' French language skills in Chad, the Comoros, Burkina Faso, the Central African Republic, the Democratic Republic of Congo, Niger, Mali and Vanuatu in the South Pacific [24]. In Spain, too, we can confirm a similarly high rate of teacher participation in

Massive Open Online Courses (MOOC) unrelated to teacher training [25]. Interestingly, this same data also showed that teachers were enthusiastic participants in MOOC [25].

In this sense, one way to innovate in teacher training could be to offer training programs through e-learning, MOOC or other modalities that, on the one hand, enable communication, interaction and collaboration through digital technologies and, on the other, make it possible to train teachers at a distance using digital technologies, providing innovation and modernization in training.

It should be noted that MOOC “are a continuation of the trend towards innovation, experimentation, and the use of technology initiated by distance and online learning, to offer learning opportunities on a massive scale” [26]). In this sense, they can be a very interesting and useful modality to help innovate in teacher training. The “NAU - Ensino e Formação Online para Grandes Audiências” platform in Portugal is a successful example of an online project to support teaching and training, which allows courses to be created in MOOC format, with thousands of people taking part [27].

In addition to digital, it is important to innovate pedagogically, in particular by adopting active methodologies that make teacher training more dynamic, contributing to a better understanding of the topics covered and, consequently, to the motivation and involvement of all teachers.

Active learning methodologies have been the subject of study and research in the field of education and technology, and recently their research and use have increased. They have emerged to counter the formal logic of teaching practices, which is based on passive methodologies in which the teacher is the main agent of this process, with the principle of providing students with different tools to collaborate with their integral formation [28]. These methodologies “are pedagogical alternatives that place the focus of the teaching and learning process on the student, involving them in learning through discovery, investigation or problem-solving” [29]. They are useful strategies in the teaching-learning process and can be considered forms of teaching in which students are encouraged to participate in the process more directly, hence their importance in the context of teacher training.

The greater the student’s involvement in the content discussed, the greater their capacity for understanding [30]. We emphasize that we are presenting active methodologies as viable pedagogical alternatives in various learning scenarios and not as an obligation for all types of content and pedagogical situations. Teacher training is precisely one of these scenarios.

Thus, integrating these methodologies into teacher training is essential as a way of contributing to the dynamization of training (active teacher participation, stimulation of critical thinking, problem solving, creativity, among others), but also to encourage teachers to adopt them to dynamize and improve the quality of the teaching-learning process.

Although there are many ways to innovate in teacher training in the literature [9, 10, 31–36], in this section, we are concerned with reflecting on the digital and pedagogical dimensions, since both emerge as fundamental pillars for today’s educational development. Continuous training geared towards innovation prepares teachers to keep up with the dynamic changes in society and students for an increasingly digitalized future. Thus,

investing in innovation in teacher training not only raises the quality of teaching but also empowers the next generation to face the challenges.

3 Methodology

This research aims to identify, through a bibliographical survey, the main innovative trends in teacher training. The bibliographic survey was carried out according to the following set of criteria: (i) Time period: 2019–2024 (last 5 years); (ii) Keywords in English: “innovation in teacher training”; “innovation in continuing teacher training”; “innovation in teacher professional development”; (iii) Keywords in Portuguese: “inovação na formação de professores”; “inovação na formação continua de professores”; “inovação no desenvolvimento profissional de professores”; (iv) Documents: reference articles; (v) Search language: English and Portuguese; (vi) Bibliometric databases: Scopus; (vii) Other databases: B-On and Scielo. Once the documents had been collected, a content analysis was carried out in order to identify the current trends in teacher training and identify a set of recommendations for innovation and modernization of teacher education.

It should be noted that although we had found a total of 24 articles, we opted to select half of them, i.e. those that would be in a better position to respond adequately to our research objective. In this sense, only 12 articles were selected, which we will identify below.

The data collected from the documents that emerged from the search were categorized and treated in Microsoft Excel. Two main categories were created: Future educational trends and recommendations for innovation and modernization of teacher training. For each of these categories, all the corresponding data were associated.

It should also be noted that the results are presented in the two main categories we have defined, but we have created two more subcategories that emerged from the content analysis carried out, and which will allow us to better organize and group all the information: technology and pedagogy.

4 Results

Innovation in teacher training is essential in preparing teachers to face the contemporary challenges of education. Up-to-date training allows teachers to develop essential skills to meet the diverse needs of students, using innovative teaching methodologies and technological tools that promote more meaningful and inclusive learning. In addition, constant updating of teacher training makes it possible to adapt to social, cultural, and technological changes, enabling them to keep up with the fast pace of today’s world and to contribute effectively to the formation of critical, creative citizens who are prepared for the challenges of the 21st century.

Technology:

- The sociocultural approach is essential for the development of teaching digital skills [37], as it recognizes the influence of social interactions in the process of acquiring and applying digital skills. By considering the individual characteristics of teachers, this

approach facilitates the effective integration of digital technologies into pedagogical practices [38]–[41], ensuring their relevance, significance and inclusion;

- Initial teacher training should focus on developing digital competence from the beginning of the teaching career [37]. It is essential to prepare teachers to face the challenges [42, 43] and take advantage of the opportunities provided by the use of digital technologies in current education. Teachers must acquire digital skills [1, 44, 45] from an early age to use them effectively in their pedagogical practice, promoting more active, collaborative learning adapted to reality;
- Collaboration with educational institutions is essential to promote quality digital training among teaching staff [37]. Collaboration facilitates the exchange of experiences between teachers and contributes to the harmonious integration of digital skills into pedagogical practice, ensuring effective preparation for the use of digital technologies in education;
- Reform the curricular structure of teacher training programs to incorporate modern information and communication technologies. This would ensure that the focus is on student learning, dividing the curriculum into general education, subject-specific education, and specific didactics, whilst integrating modern technologies [46];
- Encourage reflective practices on the use of educational technologies and rethink the educational panorama within educational institutions [46]. This is important because it can allow for a more effective integration of digital tools and ensure a relevant and more meaningful education for students.
- The introduction of augmented reality as an innovative teaching tool promotes greater enthusiasm, creativity, innovation, participation, and motivation [47]. Augmented reality promotes a more engaging and motivating educational environment, awakening students' enthusiasm and encouraging active participation [48]. It stimulates creativity and innovation, allowing students to explore concepts in a practical and immersive way, which facilitates the understanding and application of knowledge;
- The importance of understanding and adopting the TPACK (Technological Pedagogical Content Knowledge) theoretical model as a tool to understand how technology can be used by teachers to improve students' learning experience [49]; The model is crucial because it integrates technological, pedagogical, and content knowledge [41], empowering teachers to use technology in meaningful ways to improve student learning. By considering the intersection of these areas, the TPACK model helps teachers improve their teaching practices [50, 51], develop digital skills, and create personalized learning experiences;
- The use of open technological resources is also a necessity that supports the construction of knowledge by participants in online teacher training programs [49].

Pedagogy:

- Implementing teacher self-training modalities as a powerful mechanism for developing practical thinking and seeking breakthroughs in teaching practice [52]. This can be useful because it offers teachers autonomy to explore specific areas of interest, adapt their learning to individual classroom needs, and promote solid commitment, resulting in a more reflective, up-to-date, and innovative teaching practice [53];

- Combining peer training and pedagogical support to strengthen professional development [52]. This is important to provide a collaborative and contextualized approach, allowing the exchange of experiences, strategies, and best practices. It offers constructive feedback, promoting a collaborative and mutually supportive learning environment [54], resulting in a significant improvement in the quality of teaching;
- Adopting a model of teacher professional development that is closer to the parameters of adult education and less prescriptive [52]. This personalized approach allows teachers to meet your specific needs, encouraging critical reflection, experimentation, and peer collaboration. In this way, you can contribute to more significant and sustainable professional growth;
- Implementation of the flipped classroom model to improve student performance, especially in university contexts [55]. This model places the student at the center of the learning process, promoting autonomy and responsibility for prior study of the materials [56, 57]. It allows personalization of teaching, meeting students' individual needs, and preparing them more effectively for future challenges;
- Application of active methodologies [29], such as role playing and educational videos, in teacher training to increase skills such as motivation, creativity, and collaboration among students [55]. The need for a methodological shift in contemporary classrooms to enable the adaptation and integration of material resources towards the acquisition of 21st-century skills [47]. This type of methodology promotes the development of essential skills, such as motivation, creativity, and collaboration among students.
- Promotion of 4learning and innovation skills (Critical Thinking, Creativity, Collaboration, and Communication) [58]. Use of teaching strategies that encourage skills such as scientific literacy and critical thinking [58]. The importance of collaboration between teachers, as one of the premises of pedagogical innovation, is an essential element in the strategy for introducing innovation in teacher training [49]. Integration of moments of reflection and self-assessment to identify areas for improvement and combine theory with practice.
- Prioritization of transformative innovations in teacher training by the profession itself [53]. Prioritization ensures that teachers are prepared to face contemporary educational challenges;
- An approach centered on equity and social justice, which seeks to examine and overcome existing barriers and adopt a restorative stance towards education as a human enterprise [53];

5 Conclusions

The proposed innovations offer a comprehensive and integrated approach to preparing teachers for the challenges and opportunities of contemporary education. From a technological point of view, the sociocultural approach recognizes the importance of social interactions in the development of digital skills, while the introduction of modern technologies, such as augmented reality or artificial intelligence, promotes a more engaging and motivating educational environment. Furthermore, understanding and adopting the TPACK model empowers teachers to meaningfully integrate technology into their teaching practice, aiming to improve students' learning experience. In the dimension of pedagogy, the implementation of self-training and peer-to-peer training modalities

promotes reflection and innovation in teaching practice, while the adoption of active and student-centered methodologies, such as the flipped classroom, prepares teachers to meet a student-centered education. Furthermore, an approach focused on equity and social justice aims to overcome existing barriers and promote inclusive and restorative education. Together, these innovations aim to ensure that teachers are prepared to provide education that is relevant, meaningful, and adapted to the needs of students in an increasingly digital and diverse world.

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